4. ENVIRONMENTAL CONSEQUENCES

The first part of this chapter (Section 4.1) establishes the methodology used to calculate public and worker risk under both routine operations and various accident scenarios. Uranium source terms, assumed accident frequencies, and other parameters needed to model facility accident scenarios are defined in Appendix A. The transportation analysis is described in Appendix B. Ecological and human health methodology and detailed analysis are presented in Appendix C. Detailed results of the modeling are presented in tables showing all storage alternatives and disposition options under all credible accident scenarios. Section 4.2 addresses environmental consequences common to all alternatives and options. Sections 4.3 through 4.9 summarize the environmental consequences for each storage alternative. Section 4.10 summarizes the environmental consequences for each disposition option. Section 4.11 provides a summary comparing the impacts of each storage alternative coupled with disposition options, and Section 4.12 addresses cumulative impacts.

4.1 METHODS

This section describes environmental and socioeconomic impact methods and risk to the public, a co-located worker, and a facility worker due to continued storage of uranium materials at their current locations (No Action alternative), and receipt, interim storage, and disposition of these materials at other sites as described in Chapter 2. Risks are evaluated for routine operations and nonroutine (accident) conditions.

Routine or normal operations include construction of any new storage facilities, upgrades to existing facilities, and maintenance and surveillance. Construction costs and the number of permanent workers (maintenance and surveillance) are estimated based on the space needed for uranium materials storage and disposition. The number of construction workers is estimated assuming that half the construction costs are labor and each worker earns $20,000 per year. The permanent labor force to monitor storage in various warehousing locations is assumed to be one worker/18,000 ft^2 of storage space. Land for new building construction is assumed to be 25% greater than floor space needs, and single-story buildings are assumed to be used.

In addition, various disposition options are considered. These include commercial processing and domestic sales of the entire inventory, disposition of limited quantities (50 MTU) at research facilities, disposition of 2,500 MTU to other government agencies, and foreign sales of 4,050 MTU. Bounding analyses are provided for these options; disposition options should be considered a possible component of each interim storage alternative.

The number of parameters that could affect the off-site human health and environmental consequences of a catastrophic release is vast. For example, the assumptions regarding wind speed, wind direction, height of plume, the amount of uranium affected, the amount of dilution, and the area of deposition could vary in some cases by orders of magnitude. Because of the complexity involved with multiple varying assumptions, worst-case assumptions for off-site transport and human health dose at each potential storage location are employed according to the rationale described in this section.

For assessment of environmental consequences, the worst-case accident is assumed to be a seismic event and resulting fire that breaches a large number of containers and results in a plume that entrains a large portion of the uranium source material. It is further assumed that the plume moves directly via the shortest distance from the release point to a potential receptor at the facility boundary and that all of the uranium in the plume is respirable. Even though this scenario is considered to be extremely unlikely, it is still assumed that a resulting plume from a seismic event and fire would be the most likely worst-case accident to get the highest concentration of source material to the nearest off-site receptor (i.e., compared to a tornado). This is especially

true given the form of the majority of the uranium (e.g., oxides or other physical forms that may be more readily dispersible than solid forms such as ingots or recyclable pieces of metal). The hypothetical seismic/fire scenario also results in the worst-case exposure pathway (inhalation), because uranium is predominately an alpha-particle emitter. This is addressed in greater detail in Appendix C.

Uranium released from primary containers under the accident scenario described above and modeled later in this section can be deposited on surface soils and be subject to movement with soil water through the vadose zone into groundwater. The material could also be deposited directly into water bodies or move from the surface soil overland into water bodies. As described below, any exposure pathway to human receptors via soil, groundwater, or surface water would be relatively unimportant compared to the inhalation pathway to the nearest off-site receptor.

Upon deposition of the uranium entrained in the plume, the fate and transport of uranium is a function of the environmental site characteristics and the physical/chemical properties of uranium. Such properties include uranium's solubility in water, the tendency of uranium to transform or degrade (e.g., ^{238}U has a half-life of 4.5 billion years), and chemical affinity for solids or organic matter (described as a partitioning coefficient K_d). An average K_d value for uranium is 15 L/kg, although the possible range of K_ds can vary widely (Sheppard and Thibault 1990). Contaminants with small K_ds will be leached more effectively into the groundwater (i.e., be more mobile) than those with larger K_ds. For example, uranium is much less mobile than ^{99}Tc, which has a K_d of 0.1 L/kg.

In addition, uranium can be transformed to other oxidation states in soil, further reducing its mobility. If organic matter, clay, and hydrous oxides are present in the receiving soils, adsorption of the uranium metal may occur onto these materials, also reducing the uranium's mobility and toxicity. The soils described in Chapter 3 are generally rich in clay and organic matter and would be effective in retarding the mobility of uranium. Further, even if resuspended and available to an off-site receptor via inhalation, uranium concentrations would be diluted compared to the concentrations available in the original plume.

Each of the potential storage locations described in Chapter 3 is located within water-rich environments (i.e., each site is near major rivers). Therefore, even though the previous paragraph supports minimal mobility of uranium in the soil, a fraction of the uranium could enter the water system upon any accidental release, especially by direct deposition from the plume. The mobility of uranium deposited onto water depends upon the type of complex (cationic or anionic) formed as a result of the physical processes acting on the uranium. Cationic species tend to adsorb to soil, and anionic species tend to move with water. Uranium released in a fire would be oxidized (be cationic) and would tend to adsorb to the soil particles entrained in the water. As with uranium deposited upon the soil, the doses to a receptor in contact with uranium in water or associated sediment would be less important than those of the receptor exposed to the initial plume.

Once in the off-site environment, the source material is assumed to intercept a human receptor. In general, uranium compounds are not easily absorbed across the gastrointestinal tract. Soluble uranium compounds demonstrate the best absorption, but this absorption is still low. Uranium is known to be a chemical toxicant, exposure to which leads to nephritis in the kidney. Uranium can also induce cancer when organs and tissues are exposed to alpha particles emitted from decaying uranium atoms. While other energetic emissions from radioactive decay of atoms, such as beta particles and gamma rays, also cause molecular ionization, these radiations do not produce the density of ionizations that alpha particles do when inside the human body. The ionization events cause biological damage, which is believed to be responsible for inducing cells to become cancerous. The types of uranium (e.g., natural, enriched, and depleted) under consideration are important because different types of uranium have different specific activities (the amount of radioactivity per unit mass). The difference between natural, low-enriched, and depleted uranium is defined by the percent ^{235}U mass enrichment. As the ^{235}U enrichment increases, the specific activity of the mixture increases. The different quantities of source material and their associated activities are considered in the quantitative assessment that follows.

The potential adverse effects of the uranium source material in environmental media, such as groundwater, surface water, soil, or sediment, are relatively unimportant when compared to a release of the source material into the air from various accident scenarios. Therefore, the quantitative assessment provided in this section will address the inhalation exposure pathway and the resulting calculated dose from both routine operations and various accident scenarios.

For risks due to transportation, the excess latent cancer fatalities (LCFs) were computed from Table B.4 by adding the LCFs from both incident-free and accident situations for both truck only and truck plus rail transport. This shows the total LCFs to the public from all transportation sources. The average individual consequences and traffic fatalities are also totals computed from Appendix B tables.

4.2 CONSEQUENCES COMMON TO ALL ALTERNATIVES

Regardless of the alternative, there are some actions common to all, and the resulting consequences are the same for all alternatives. For each alternative, including No Action, there will be routine handling and monitoring of the uranium inventory. In instances where packaging needs to be upgraded, the materials would be overpacked or otherwise repackaged to meet safety requirements. However, it is assumed that for both the centralized and consolidated storage alternatives that require some or all of the uranium materials to be shipped, a much more substantial repackaging effort would be required than for No Action. Both acute and chronic consequences and risk due to accidents that may occur during container handling activities are negligible under all alternatives.

During interim storage of uranium materials, workers could be exposed to direct radiation from surface contamination on the storage containers. However, the containers have been checked and would be overpacked if this is deemed necessary. Therefore, worker exposure due to routine operations associated with surveillance and maintenance of stored materials is expected to be less than detectable levels. Normal operations under any alternative are expected to cause negligible acute and chronic risks from airborne uranium.

In addition to surface contamination, non-contact radiation dose from the stored uranium materials can be expected. Dose rates from any single stored container are no more than 3 to 4 mrem/h. The dose rate at a distance of 0.3 m (1 ft) from a container is ~1 mrem/h, and the dose rate at a distance of 6 m (20 ft) is <0.05 mrem/h (approximately the same as normal background radiation doses) (DOE 1999). These dose rates are not affected by stacking the containers, because the containers and the materials themselves provide substantial shielding. For worker and collocated worker exposure, the shielding was assumed to cancel out the effect of adding additional containers. However, when calculating doses to the public, the more conservative assumption of no shielding was used. These dose rates are considered negligible to any receptor (facility worker, co-located worker, or public).

For all the action alternatives, small quantities of uranium materials would be shipped to and from university and other sites. The consequences of small quantity (less than 0.1 MTU) shipments are inconsequential, would not be a substantial cumulative impact when added to the 14,200 MTU under consideration, and would vary little from alternative to alternative. The impacts associated with the various disposition options are common to all alternatives.

Regarding Intentional Destructive Acts such as sabotage or terrorism, there are no known or reasonably anticipated scenarios that would result in human consequences greater than those already evaluated for fires, which are negligible. The types of uranium materials covered in this PEA are not considered to be reasonable targets for terrorists.

4.3 NO ACTION ALTERNATIVE

Under this alternative, the uranium currently stored at the various DOE sites, non-DOE sites, universities, and other commercial locations would remain at those sites. The uranium is currently in various container types, including 55-gal steel drums, T-hoppers, half-high boxes, and sea-land containers.

4.3.1 Normal Operations

Under normal operations, land use, geology and soils, water resources, cultural resources, and the infrastructure remain unchanged. Air effluents associated with uranium inventory maintenance would be minimal and would remain the same as they are now. Because there is no new construction and there are no effluents from the stored uranium, plant and animal species would not be adversely affected and cultural resources would not be impacted. Some continued maintenance of facilities would be required, and monitoring and surveillance at the current sites would continue. The socioeconomic impact analysis assumes little or no construction activity and continued uranium monitoring by current employees. Under these assumptions, there is no change in expenditure or employment and, consequently, no impact. Even if additional workers were hired for monitoring at each potential centralized or consolidated storage site, they would represent a minimal increase to the large number (several hundred thousand) of wage and salary earners present in counties that contain the larger DOE uranium storage sites. In the absence of important impacts, environmental justice concerns do not arise.

The 3,900 MTU at the 152 locations other than the six DOE locations would remain at these sites. The amount at each individual site is very small and is typically associated with university or other types of research. No substantial environmental impacts are expected from the continued use and/or storage at these locations; however, these sites do not have a long-term mission for uranium storage and expect to ship materials back to DOE when the research work is completed.

4.3.2 Facility Accidents

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A and summarized in Table 4.1. The highest acute consequences to the public or to a co-located worker are due to a fire or earthquake at PORTS, with aerial dispersion of uranium materials, but is still negligible. This result is based on the large amount of uranium materials currently stored at PORTS (4,400 MTU or ~31% of the total of 14,200 MTU). Acute radiological and toxicological consequences are negligible at all other sites.

Human health and ecological risk are evaluated in Appendix C and summarized in Table 4.1. Accidents at all facilities are expected to cause negligible to low chronic risks to humans and ecological receptors.

4.3.3 Transportation

There are no transportation activities associated with the No Action alternative.

4.4 INTERIM CENTRALIZED STORAGE AT A SINGLE DOE SITE

This alternative involves moving all uranium materials to one of six DOE sites (INEEL, PGDP, PORTS, SRS, or Oak Ridge – Y-12 Complex and ETTP). The total amount to be moved depends on the amount currently stored at the site. Once all the materials have been moved, the total at any site is the same (14,200 MTU).

Table 4.1. Risks due to accidents for No Action alternative

Accident scenario	Site(s)	Maximum acute risk		Chronic human health risk		Chronic ecological risk	
		Consequence level	Overall risk	Consequence level	Overall risk	Consequence level	Overall risk
Facility fire	INEEL, PGDP, SRS, Oak Ridge, Max other[a]	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	PORTS	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Seismic	INEEL, PGDP, SRS, Oak Ridge, Max other[a]	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	PORTS	Negligible	Negligible	Negligible	Negligible	Low	Low

[a]Max other represents the largest single amount at any site other than the DOE consolidated storage locations.
DOE = U.S. Department of Energy.
INEEL = Idaho National Engineering and Environmental Laboratory.
PGDP = Paducah Gaseous Diffusion Plant.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

4.4.1 Normal Operations

Under this alternative, the amount of uranium stored at one of the six DOE sites would increase from current levels to 14,200 MTU, as shown in Table 4.2. The total floor space required for storage would also increase to ~243,000 ft^2.

Table 4.2. Storage requirements for interim centralized storage at a single DOE site

Site	Assumed storage			Materials to be moved		
	Amount, 10^3 MTU	Number of containers	Storage requirement, ft^2	Amount, 10^3 MTU	Number of containers	Additional storage requirement, ft^2
INEEL	1.5	639	7,000	12.7	71,195	~236,000
PGDP	<0.1	8	100	14.1	71,821	~243,000
PORTS	4.4	24,765	75,000	9.8	47,069	~168,000[a]
SRS	3.0	2,876	19,000	11.2	68,967	~224,000
Oak Ridge	1.4	6,431	25,000	12.8	65,403	~218,000

[a]~450,000 ft^2 existing space available at PORTS.
DOE = U.S. Department of Energy.
INEEL = Idaho National Engineering and Environmental Laboratory.
MTU = metric tons of uranium.
PGDP = Paducah Gaseous Diffusion Plant.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

Additional requirements, activities, and environmental impacts are summarized in Table 4.3.

Table 4.3. Impacts for interim centralized storage at a single DOE site

	Requirements			Activities		Environmental impacts	
Site	Initial workers	Permanent workers	Estimated upgrades	New construction	Availability of space	Air, water, etc.	Socioeconomics
INEEL	413	13	$16.5M	Yes	Unknown	Minor	Minor
PGDP	425	14	$17.0M	Yes	Unknown	Minor	Minor
PORTS	210	9	$8.4M	None	Yes	Minimal	Minimal
SRS	393	12	$15.7M	Yes	Unknown	Minor	Minor
Oak Ridge	383	12	$15.3M	Yes	Unknown	Minor	Minor

DOE = U.S. Department of Energy.
INEEL = Idaho National Engineering and Environmental Laboratory.
MTU = metric tons of uranium.
PGDP = Paducah Gaseous Diffusion Plant.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

PORTS is the only DOE site with sufficient existing storage space to accommodate the entire uranium material inventory. PORTS has several large buildings with sufficient capacity to store these materials. These buildings were evaluated for uranium storage suitability (DOE 1999), and over 450,000 ft^2 of space is still available in them. Some minor work would be required to prepare the buildings, but no new construction would be anticipated. Under normal operations, land use, geology and soils, water resources, cultural resources, and the infrastructure at PORTS would remain unchanged. Air effluents associated with uranium inventory maintenance would be minimal and would remain the same as present. Because there is no new construction and there are no effluents from the stored uranium, plant and animal species would not be adversely affected, and cultural resources would not be impacted.

While existing storage space is available at this time, various potential changes at PORTS could eliminate some of this space. Therefore, it is assumed that up to 125,000 ft^2 of new space could be constructed. Under this assumption, the upgrades cost would increase from $8.4M to $10.9M, and the number of construction workers from 210 to 273. Environmental impacts and socioeconomic impacts would increase from minimal to minor. Even with some new construction, the PORTS site would still be the least expensive site for this alternative.

DOE has not identified existing buildings at INEEL, PGDP, SRS, or Oak Ridge (either the Y-12 Complex or ETTP) to accommodate these additional uranium materials at this time. Therefore, for analysis purposes, it is assumed that new storage space would have to be constructed. It is further assumed that such construction would occur in areas of the site that are already industrialized. This would minimize potential impacts to sensitive species but would permanently eliminate the habitat for existing biota on up to 7 acres committed to the project (for new buildings and associated landscaping). Infrastructure would be slightly affected, because utilities would have to be run to these new facilities. Construction would result in minor fugitive dust emissions and disturbance of soils. However, water resources and cultural resources are not expected to be affected.

The socioeconomic analysis assumes $8.4M in building upgrades at PORTS and from $15.3M at Oak Ridge to $17.0M at the PGDP for new construction (Table 4.3). The uranium materials maintenance and surveillance workers currently located at various existing storage locations are assumed to be replaced with a

comparable number at the single DOE storage location. Thus, additional workers would be added to the site payroll.

Minor socioeconomic impacts include less than 1% increase in regional expenditures and approximately 1% increase in worker employment compared to the ROI during the first year (construction and transport) at the PGDP site; all other DOE sites have smaller increases. Permanent site employment would also increase less than 1%, and temporary construction-related employment would increase the site workforce during the first year by approximately 19% at PGDP, all other DOE sites have smaller increases. Such minor increases in expenditures and employment are not substantial.

4.4.2 Facility Accidents

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A and summarized in Table 4.4. Both facility fires and seismic events result in high acute toxicological consequences due to the potential for large quantities of uranium to become airborne in a fire. This is because most of the airborne source term (~ 73%) results from compounds, oxides, and other miscellaneous forms that are relatively more dispersible than other physical forms considered in this study. The consequences are similar at all sites because the total amount of material to be stored at each site is the same (14,200 MTU).

Table 4.4. Risks due to accidents for interim centralized storage at a single DOE site

Accident scenario	Maximum acute risk		Chronic human health risk		Chronic ecological risk	
	Consequence level	Overall risk	Consequence level	Overall risk	Consequence level	Overall risk
Storage area fire	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Seismic	Low	Low	Low	Low	Negligible	Negligible

DOE = U.S. Department of Energy.

Human health and ecological risk are evaluated in Appendix C and summarized in Table 4.4. Accidents at all facilities are expected to cause negligible to low chronic risks to humans and ecological receptors. In Table 4.5 the LCFs to the public are a sum of all transportation sources (incident-free and accidents from both truck only and truck plus rail transport). The average individual consequences and traffic fatalities are also totals computed from Appendix B tables.

4.4.3 Transportation

The potential effects of transporting uranium materials for long-term centralized storage at a single DOE site are evaluated in Appendix B and summarized in Table 4.5.

Table 4.5. Transportation effects for interim centralized storage at a single DOE site

Destination location	Average individual consequences, mrem	Excess latent cancer fatalities	Traffic fatalities
INEEL	0.0059	0.024	0.017
PGDP	0.0091	0.020	0.011
PORTS	0.0084	0.019	0.010
SRS	0.0109	0.029	0.012
Oak Ridge	0.0092	0.021	0.010

DOE = U.S. Department of Energy
INEEL = Idaho National Engineering and Environmental Laboratory
PGDP = Paducah Gaseous Diffusion Plant
PORTS = Portsmouth Gaseous Diffusion Plant
SRS = Savannah River Site

4.5 INTERIM CENTRALIZED STORAGE AT A SINGLE COMMERCIAL SITE

This alternative involves moving all uranium materials to a single commercial site in either the eastern or the western United States. The total amount to be moved and stored would be 14,200 MTU.

4.5.1 Normal Operations

Under this alternative, the amount of uranium stored at a commercial site is the same as the total of 14,200 MTU. The total floor space required for storage is ~243,000 ft^2; all would be new construction. These are the same total storage requirements discussed in Section 4.4.1.

DOE has not identified specific locations for commercial sites; however, for purposes of evaluation, a western or eastern site has been hypothesized as a potential alternative. Since the sites are generically identified, no existing buildings have been assumed to be available. This assumption produces a reasonable worst case in terms of impacts. Table 4.6 summarizes expected impacts from normal operations.

Table 4.6. Impacts for interim centralized storage at a single commercial site

	Requirements			Activities		Environmental impacts	
Site	Initial workers	Permanent workers	Estimated upgrades	New construction	Availability of space	Air, water, etc.	Socioeconomics
Western or eastern	425	14	$17.0M	Yes	Unknown	Minor	Minor

At either site, the number of initial workers for the first-year construction, the number of permanent workers, and the costs of construction would equal or exceed those for the DOE sites considered for centralized storage. Approximately 7 acres of land would be required for the storage facilities, and the biota occupying this land would be permanently displaced and their habitat lost. It is assumed that previously developed land with no known cultural resources would be used. Assuming best management practices are followed during construction (such as use of silt fences, reseeding disturbed areas, etc.), impacts to any surface waters would be minor and short-term. Socioeconomic impacts would be minor and include less than 1% increase in regional expenditures and less than 1% increase in worker employment in the region during the first-year construction phase.

4.5.2 Facility Accidents

Acute consequences associated with storage area fires and seismic events are evaluated in Appendix A. Human health and ecological risk are evaluated in Appendix C. Both acute and chronic consequences and risk are the same as for centralized storage at a DOE site (see Table 4.4) because the total amount of material to be stored at each site is the same (14,200 MTU).

4.5.3 Transportation

The potential effects of transporting uranium materials for long-term centralized storage at a single commercial site are evaluated in Appendix B and summarized in Table 4.7.

Table 4.7. Transportation effects for interim centralized storage at a commercial site

Destination location	Average individual consequences, mrem	Excess latent cancer fatalities (total)	Traffic fatalities (total)
Western	0.0041	0.013	0.012
Eastern	0.0047	0.022	0.017

4.6 INTERIM PARTIALLY CONSOLIDATED STORAGE AT SEVERAL DOE SITES

This alternative involves moving uranium materials from their current storage location to the closest of six DOE sites (INEEL, PGDP, PORTS, SRS, Y-12 Complex, and ETTP). The total amount to be moved depends on the amount now stored at the sites. In addition, the total amounts to be stored at any given location vary depending on the number of other sites and amounts of material that are considered closest to the consolidation location. Unlike the two centralized alternatives in which the impacts at each site are independent (i.e., inputs would occur at one site), the consolidated storage alternative results in impacts at all six DOE sites.

4.6.1 Normal Operations

Under this alternative, the existing uranium materials inventory at any one of the six DOE consolidation sites would remain at its respective location, and the 3,900 MTU currently at the 152 other locations would be transported and stored at the six DOE consolidated storage sites. The materials at each of the 152 sites would be stored at the geographically closest DOE consolidation site. The amount of uranium stored at each of the six DOE sites would increase from current levels to the levels shown in Table 4.8. The total floor space required for storage would also increase.

Table 4.8. Storage requirements for interim partially consolidated storage at several DOE sites

	Assumed storage			Materials to be moved		
Site	Amount, 10^3 MTU	Number of containers	Storage requirement, ft^2	Amount, 10^3 MTU	Number of containers	Additional storage requirement, ft^2
INEEL	1.5	639	7,000	1.7	21,391	71,000
PGDP	<0.1	8	100	0.4	400	2,000
PORTS	4.4	24,765	75,000	1.4	13,458	40,000
SRS	3.0	2,867	19,000	<0.1	63	<100
Oak Ridge	1.4	6,431	25,000	0.4	1,812	2,500

DOE = U.S. Department of Energy.
INEEL = Idaho National Engineering and Environmental Laboratory.
MTU = metric tons of uranium.
PGDP = Paducah Gaseous Diffusion Plant.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

Because of the small amount of additional uranium material to be received at each consolidated storage site, the impacts are similar to the No Action alternative (see Section 4.3.1). Since INEEL would receive the most additional materials (1,700 MTU), this site serves as the worst case for normal operations impacts as shown in Table 4.9.

Table 4.9. Impacts for interim partially consolidated storage at several DOE sites

	Requirements			Activities		Environmental impacts	
Site	Initial workers	Permanent workers	Estimated upgrades	New construction	Availability of space	Air, water, etc.	Socioeconomics
INEEL	125	4	$5.0M	Yes	Unknown	Minor	Minimal
PGDP	4	<1	$140K	Yes	Unknown	Minor	Minimal
PORTS	50	3	$2.0M	No	Yes	Negligible	Minimal
SRS	0	0	0	Yes	Unknown	Minimal	Minimal
Oak Ridge	4	<1	$175K	Yes	Unknown	Minimal	Minimal

DOE = U.S. Department of Energy.
INEEL = Idaho National Engineering and Environmental Laboratory.
K = thousand dollars.
M = million dollars.
PGDP = Paducah Gaseous Diffusion Plant.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

INEEL would have the largest construction cost, most workers, and 2 acres of land permanently committed to new storage space. Environmental impacts are minor. Impacts for the other consolidation sites would be minor or minimal. The impacts at PORTS would be negligible, because there would be no new construction at this site.

For this alternative the cumulative construction/upgrades cost of ~$7.3M for all the sites should be considered as the total construction-related cost even though the bulk ($5.0M) would be at INEEL. Socioeconomic impacts would be minimal at all sites.

4.6.2 Facility Accidents

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A and summarized in Table 4.10. Both storage area fires and seismic events at PORTS can result in greater than negligible toxicological consequences due to the potential for large quantities of uranium to become airborne in a fire. This result is based on the large amount of oxides currently stored at PORTS and the relatively dispersible nature of these materials compared to the other physical forms considered in this study. Acute radiological and toxicological consequences are negligible at all other sites.

Human health and ecological risk are evaluated in Appendix C and summarized in Table 4.10. Accidents at all facilities are expected to cause negligible to low chronic risks to humans and ecological receptors. Accident risk is expected to occur at all six DOE sites.

Table 4.10. Risks due to accidents for interim partially consolidated storage at several DOE sites

Accident scenario	Site(s)	Maximum acute risk		Chronic human health risk		Chronic ecological risk	
		Consequence level	Overall risk	Consequence level	Overall risk	Consequence level	Overall risk
Facility fire	INEEL, PGDP, SRS, Oak Ridge	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	PORTS	Low	Low	Negligible	Negligible	Negligible	Negligible
Seismic	INEEL, PGDP, Oak Ridge	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	PORTS	Low	Low	Negligible	Negligible	Low	Low

DOE = U.S. Department of Energy.
INEEL = Idaho National Engineering and Environmental Laboratory.
PGDP = Paducah Gaseous Diffusion Plant.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

4.6.3 Transportation

The potential effects of transporting uranium materials for consolidated storage at several DOE sites are evaluated in Appendix B and summarized in Table 4.11.

Table 4.11. Transportation effects for interim partially consolidated storage at several DOE sites

Destination location	Average individual consequences, mrem	Excess latent cancer fatalities (total)	Traffic fatalities (total)
All	0.0016	0.003	0.005

DOE = U.S. Department of Energy.

These effects represent total effects for transporting materials to all six potential DOE storage locations. The effects are less than those for the centralized storage alternatives because materials are transported to the closest site, thus minimizing transport miles.

4.7 INTERIM PARTIALLY CONSOLIDATED STORAGE AT TWO DOE SITES

This alternative involves moving uranium materials from their current storage location to the closest of two DOE sites (INEEL or PORTS). The total amount to be moved depends on the amount now stored at the sites. In addition, the total amounts to be stored at any given location vary depending on the number of other sites and amounts of materials that are considered closest to the consolidation location.

4.7.1 Normal Operations

Under this alternative, the uranium materials stored at the two DOE sites would increase from current levels to the levels shown in Table 4.12. The total floor space required for storage would also increase at both sites.

Table 4.12. Storage requirements for interim partially consolidated storage at two DOE sites

	Assumed storage			Materials to be moved		
Site	Amount, 10^3 MTU	Number of containers	Storage requirement, ft^2	Amount, 10^3 MTU	Number of containers	Additional storage requirement, ft^2
INEEL	1.5	639	7,000	1.7	21,490	72,000
PORTS	4.4	24,765	75,000	6.6	24,940	89,000

DOE = U.S. Department of Energy
INEEL = Idaho National Engineering and Environmental Laboratory
MTU = metric tons of uranium
PORTS = Portsmouth Gaseous Diffusion Plant

Additional requirements, activities, and environmental impacts are summarized in Table 4.13.

For this alternative, the cumulative construction/upgrades cost of $9.5M should be considered as the construction-related cost. At INEEL, because the amount of additional material to be stored is the same as that discussed in Section 4.6.1, the environmental impacts from normal operations would also be the same. For the PORTS site, even though there would be up to 111 workers during the first year for building upgrades, upgrade activities do not require additional land and habitat, nor do they result in large emissions to air and water. Thus, environmental impacts at PORTS would tend to be negligible. Because the regional economy and workforce at PORTS are smaller than for INEEL, socioeconomic effects are slightly larger but are still minor with approximately 2.4% increase in regional expenditures and 5% increase in construction-related employment.

Table 4.13. Impacts for interim partially consolidated storage at two DOE sites

	Requirements			Activities		Environmental impacts	
Site	Initial workers	Permanent workers	Estimated upgrades	New construction	Availability of space	Air, water, etc.	Socioeconomics
INEEL	125	4	$5.0M	Yes	Unknown	Minor	Minimal
PORTS	111	5	$4.5M	No	Yes	Negligible	Minor

DOE = U.S. Department of Energy
INEEL = Idaho National Engineering and Environmental Laboratory
PORTS = Portsmouth Gaseous Diffusion Plant

4.7.2 Facility Accidents

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A and summarized in Table 4.14. The seismic event at PORTS can result in low toxicological consequences due to the potential for large quantities of uranium to become airborne in a fire. This is because most of the airborne source term (~ 90%) results from compounds and oxides that are relatively more dispersible than other physical forms considered in this study. Radiological and toxicological consequences are negligible at INEEL.

Table 4.14. Risks due to accidents for interim partially consolidated storage at two DOE sites

Accident scenario	Site(s)	Maximum acute risk		Chronic human health risk		Chronic ecological risk	
		Consequence level	Overall risk	Consequence level	Overall risk	Consequence level	Overall risk
Facility fire	INEEL	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	PORTS	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Seismic	INEEL	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	PORTS	Low	Low	Negligible	Negligible	Negligible	Negligible

DOE = U.S. Department of Energy.
INEEL = Idaho National Engineering and Environmental Laboratory.
PORTS = Portsmouth Gaseous Diffusion Plant.

Human health and ecological risk are evaluated in Appendix C and summarized in Table 4.14. Accidents at both facilities are expected to cause negligible to low chronic risks to humans and ecological receptors.

4.7.3 Transportation

The potential effects of transporting uranium materials for consolidated storage at two DOE sites are evaluated in Appendix B and summarized in Table 4.15.

Table 4.15. Transportation effects for interim partially consolidated storage at two DOE sites

Destination location	Average individual consequences, mrem	Excess latent cancer fatalities (total)	Traffic fatalities (total)
All	0.0020	0.007	0.006

DOE = U.S. Department of Energy.

These effects represent total effects for transporting materials to two potential DOE storage locations. The effects are less than those for the centralized storage alternatives because materials are transported to the closest site, thus minimizing transport miles.

4.8 INTERIM PARTIALLY CONSOLIDATED STORAGE AT TWO COMMERCIAL SITES

This alternative involves moving uranium materials from their current storage locations to one of two commercial sites (one in the western one in the eastern United States). The total amount to be moved is 14,200 MTU, because these sites do not currently have any material stored. The total amounts to be stored at either location vary, depending on the number of sites and amounts of materials that are considered closest to the consolidation location.

4.8.1 Normal Operations

Under this alternative, the 14,200 MTU would be consolidated at two commercial sites, and the total floor space required would be at the levels shown in Table 4.12. It is assumed that all storage space would

have to be built. Additional requirements, activities, and environmental impacts are summarized in Table 4.16. The total construction cost is $17M for this alternative, and 7 acres of land would be disturbed.

Table 4.16. Impacts for interim partially consolidated storage at two commercial sites

	Requirements			Activities		Environmental impacts	
Site	Initial workers	Permanent workers	Estimated upgrades	New construction	Availability of space	Air, water, etc.	Socioeconomics
Western	138	5	$5.5M	Yes	Unknown	Minor	Minor
Eastern	288	9	$11.5M	Yes	Unknown	Minor	Minor

4.8.2 Facility Accidents

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A and are the same as those for storage at PORTS and INEEL. Both storage area fires and seismic events at the eastern site can result in high toxicological consequences due to the potential for large quantities of uranium to become airborne in a fire. Radiological and toxicological consequences are negligible at the western site.

Human health and ecological risk are evaluated in Appendix C and are the same as those for storage at PORTS and INEEL (see Table 4.14). Accidents at both facilities are expected to cause negligible to low chronic risks to humans and ecological receptors.

4.8.3 Transportation

The potential effects of transporting uranium materials for consolidated storage at two commercial sites are evaluated in Appendix B and summarized in Table 4.17.

Table 4.17. Transportation effects for interim partially consolidated storage at two commercial sites

Destination location	Average individual consequences, mrem	Excess latent cancer fatalities (total)	Traffic fatalities (total)
All	0.061	0.016	0.081

These effects represent total effects for transporting materials to two potential commercial storage locations. The effects are greater than those for the consolidated storage alternative at two DOE sites, because some materials are already stored at the DOE sites, thus increasing transport miles for this alternative.

4.9 INTERIM PARTIALLY CONSOLIDATED STORAGE BASED ON PHYSICAL FORM

This alternative involves moving uranium materials from their current storage locations to a DOE site based on the physical form of the materials (i.e., the site with the largest quantity of a specific physical form is the preferred storage location for all materials of that form). The total amount to be moved depends

on the amount of that physical form currently stored at the site. The storage plan for these materials is shown below:

Physical form	Preferred storage location
Compound	PORTS
Metal	SRS
Miscellaneous	PORTS
Oxide	PORTS
Reactfuel	INEEL
Residue	INEEL
Source	INEEL

4.9.1 Normal Operations

Under this alternative, ~8,200 MTU would be relocated to three DOE sites as shown in Table 4.18. This includes amounts that are moved from one of the three sites because that site is not the preferred site for that physical form. The net increase in total floor space required for storage is also shown in Table 4.18.

Table 4.18. Storage requirements for interim partially consolidated storage based on physical form

	Assumed storage[a]			Materials to be moved		
Site	Amount, 10^3 MTU	Number of containers	Storage requirement, ft^2	Amount, 10^3 MTU	Number of containers	Additional storage requirement, ft^2
PORTS	4.4	24,765	75,000	1.7	13,839	~25,000
SRS	3.0	2,867	19,000	6.0	32,918	~117,000
INEEL	1.5	639	7,000	0.4	1,188	~0

[a]Includes some materials that are moved to other sites so that like physical forms can be consolidated.
INEEL = Idaho National Engineering and Environmental Laboratory.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

Additional requirements, activities, and environmental impacts are summarized in Table 4.19. The total amount is $9.5M.

Approximately 3.4 acres of land would be committed to new storage space at SRS, with accompanying loss of habitat for wildlife. At PORTS, existing storage space would be used and, absent new construction, environmental impacts would be minimal. At INEEL, there are no additional storage requirements, workers or construction costs. At SRS, only minor air and water emissions would be expected, and at both PORTS and SRS, socioeconomic impacts would be minimal in relation to the regional economy and labor base.

Table 4.19. Impacts for interim partially consolidated storage based on physical form

Site	Requirements			Activities		Environmental impacts	
	Initial workers	Permanent workers	Estimated upgrades	New construction	Availability of space	Air, water, etc.	Socioeconomics
PORTS	31	2	$1.3M	No	Yes	Minimal	Minimal
SRS	205	7	$8.2M	Yes	Unknown	Minor	Minimal
INEEL	0	0	$0K	No	NA	Negligible	Negligible

INEEL = Idaho National Engineering and Environmental Laboratory.
K = thousand dollars.
M = million dollars.
NA = not applicable.
PORTS = Portsmouth Gaseous Diffusion Plant.
SRS = Savannah River Site.

4.9.2 Facility Accidents

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A and summarized in Table 4.20. The seismic event at PORTS can result in low toxicological consequences due to the potential for large quantities of uranium to become airborne in a fire. This is because most of the airborne source term (~ 90%) results from compounds and oxides that are relatively more dispersible than other physical forms considered in this study. Radiological and toxicological consequences are negligible at INEEL and SRS.

Human health and ecological risk are evaluated in Appendix C and summarized in Table 4.20. Accidents at all facilities are expected to cause negligible to low chronic risks to humans and ecological receptors.

Table 4.20. Risks due to accidents for interim partially consolidated storage based on physical form

Accident scenario	Site(s)	Maximum acute risk		Chronic human health risk		Chronic ecological risk	
		Consequence level	Overall risk	Consequence level	Overall risk	Consequence level	Overall risk
Facility fire	PORTS	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	INEEL, SRS	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Seismic	PORTS	Low	Low	Negligible	Negligible	Low	Low
	INEEL, SRS	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

INEEL = Idaho National Engineering and Environmental Laboratory
PORTS = Portsmouth Gaseous Diffusion Plant
SRS = Savannah River Site

4.9.3 Transportation

The potential effects of transporting uranium materials for consolidated storage at two commercial sites are evaluated in Appendix B and summarized in Table 4.21.

Table 4.21. Transportation effects for interim partially consolidated storage based on physical form

Destination location	Average individual consequences, mrem	Excess latent cancer fatalities (total)	Traffic fatalities (total)
All	0.0022	0.003	0.005

4.10 DISPOSITION

Each of the alternatives analyzed for some type of interim storage will also potentially have impacts related to final disposition. In Section 4.10, impacts due to the various disposition options are determined. These impacts due to disposition must be added to the impacts of each action alternative considered. The impacts of disposition are presented here as bounding conditions since many details of disposition can only be assumed at this time. As discussed in Section 2.3.8, disposition could involve commercial processing and domestic sales, use in research, use by other government agencies, and foreign sales.

Depending on the disposition option(s) employed and the specific processes involved (such as downblending for example), there would be some wastes generated. In addition, the product containers, once emptied for any option, would have to be reused as is, disposed as waste, or cleaned for reuse (generating waste in the cleaning process). These wastes would be disposed in compliance with the applicable regulations governing such waste materials. Disposition would likely take place over an extended period of time and could involve several disposition options. Thus, impacts associated with waste streams are expected to be minor since they would be intermittent and part of the expected normal operations at the disposition sites.

An estimate of the uranium inventory that would be included in each disposition option is provided. It is probable that a combination of commercial processing and domestic sales, transfer to research facilities and other government agencies, and foreign sales could occur. Since all the inventory would eventually be disposed, a rough bounding of environmental impacts would be to double the environmental impacts for the alternative(s) that have the greatest impacts already identified for them. That is, one would assume a doubling of the impacts identified for the interim storage at a single site (DOE or commercial) alternative (Sects. 4.3 and 4.4) when the impacts of disposition are added. However, there are several factors, which would realistically tend to lessen these impacts, and they are discussed below.

4.10.1 Commercial Processing and Domestic Sales

The total quantity of 14,200 MTU may be reprocessed commercially. It is likely that any commercial entities that acquired the uranium inventory would already have processing facilities and would likely take possession of the uranium inventory in such a way as to minimize or eliminate the need for building new storage facilities at the processing locations. Thus no new construction is probable. However, should construction be needed, any construction-related impacts should already be approximated by the storage at a single commercial site alternative (Section 4.5.1). That is, a temporary work force of ~300 construction workers, approximately a dozen permanent staff, and >$12M in construction costs are assumed. Processing operations costs could run several million dollars per year depending on the process and the amount of inventory reprocessed. Reprocessing activities would be likely to have relatively minor environmental and socioeconomic impacts. The potential for airborne releases during reprocessing exists but should be controlled to acceptable limits by the operating permits of the facilities.

Both acute and chronic consequences and risk associated with this option are the same as that for centralized storage at a single commercial site (see Section 4.5.2) because the total amount of material to be processed is the same (14,200 MTU).

The potential effects of transporting uranium materials to a commercial reprocessing facility are also the same as transporting the materials to a single centralized storage location (see Section 4.5.3).

4.10.2 Transfer to Research Facility

Under this option, ~50 MTU would be transferred to a single research facility assumed to be the greatest distance from an interim storage location. It is possible that there would be no new construction or building upgrades required since any research facility needing these materials would already have the personnel and facilities to handle it. However, should some new construction or upgrades be required, the storage/research space would be a few thousand square feet at most and costs, environmental impacts, and socioeconomic impacts would likely be minimal.

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A. Because the total material transferred to any given site is substantially less than the amounts transferred to any of the six potential DOE storage locations evaluated for the partially consolidated storage alternative, the acute and chronic consequences and risk for human and ecological receptors are negligible or low (see Table 4.10). Transportation effects are also less than those estimated for the partially consolidated storage alternative (see Table 4.11).

4.10.3 Transfer to Other Government Agency

Under this option, ~2,500 MTU could be provided to other government agencies. The total 2,500 MTU would be transferred to a single, unspecified location assumed to be the greatest distance from one of the interim storage locations. The specific environmental impacts experienced would be related to how much of the inventory goes to any specific agency location; however, impacts can be assumed to approximate those for the interim partially consolidated storage at several DOE sites alternatives discussion (Section 4.6). That is, assuming, as a reasonable worst case, that new construction for temporary storage is required at the receiving agency, then up to 90 construction workers, $3.6M in building costs, and minor environmental impacts would occur.

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A. The total material (~2,500 MTU) is similar to amounts transferred to some of the six potential DOE storage locations evaluated for the partially consolidated storage alternative. Acute and chronic consequences and risk to human and ecological receptors are either negligible or low (see Table 4.10). Transportation effects are also less than those estimated for the partially consolidated storage alternative (see Table 4.11).

4.10.4 Foreign Sales

Under this option, ~4,050 MTU of LEU/NU could be sold to the commercial nuclear fuel market. The total 4,050 MTU would be transferred from their interim storage locations to the closest international port and shipped via cargo vessel to the farthest port in Asia or the Far East.

Impacts due to normal operations would be negligible and associated with repackaging and transport from DOE sites to U.S. ports and from there to foreign ports-of-entry.

Acute consequences associated with facility fires and seismic events are evaluated in Appendix A. The total material (~4,050 MTU) is similar to amounts transferred to PORTS as evaluated for the partially

consolidated storage alternative. Acute and chronic consequences and risk are either negligible or low (see Table 4.10). Transportation effects are also less than those estimated for the partially consolidated storage alternative (see Table 4.11).

For overseas shipment, there is no consequence to any member of the public (i.e., only the ship's crew is exposed). The average consequence to a member of a ship's crew is estimated to be approximately 1.8 mrem per person per day for each shipment of material. A dock worker loading containers could potentially receive an external dose of ~2 mrem.

There are no anticipated adverse consequences to the marine environment from overseas shipment. However, in the very unlikely event of a ship sinking or cargo loss due to some unforeseen accident, uranium product could be deposited in the sea. Impacts would vary by location and form of uranium lost. The National Marine Fisheries Service has listed federally protected species, which could conceivably be affected (see NMFS letter to DOE, dated June 28, 2002, in Chapter 7).

4.11 SUMMARY AND CONCLUSIONS

Normal operations result in no more than negligible acute or chronic consequences and risk at any site under any storage alternative or disposition option. Environmental impacts associated with normal operations vary from alternative to alternative and, occasionally, by site within a given alternative. General handling accidents result in no more than negligible acute or chronic consequences and risk at any site under any storage alternative or disposition option. Chronic human health and ecological consequences and risk are negligible to low for all sites under all alternatives. The highest transportation consequences and risk are for alternatives that involve moving uranium materials to a western location, either to a commercial site or to INEEL.

4.11.1 Comparison of Alternatives

When comparing the environmental impacts of the various alternatives, the following emerge as general trends:

- There were none-to-minor impacts for all of the alternatives considered and negligible-to-low impacts from the standpoint of facility accidents (fire and seismic) for all the alternatives, while transportation effects for the alternatives generally reflected the extent of material transport associated with the alternative being analyzed.

- The greater the centralization or consolidation of the uranium inventory, the greater the potential for normal operations impacts. Greater centralization or consolidation means that new storage space has to be built, which means accompanying costs and commitment of land, and uranium materials will have to be shipped greater distances with increased risk of accidents.

- The action alternative with the fewest environmental impacts and that is the least expensive ($7.3M) is "Interim Partially Consolidated Storage at Several DOE Sites." This alternative takes advantage of the current storage of the majority of these DOE sites already. Thus, construction costs and associated environmental impacts would be less than other action alternatives.

- Similarly, the PORTS site would have the fewest environmental impacts and would be the least expensive ($8.4M) of the DOE facilities considered for interim centralized storage. PGDP and commercial sites would be the most expensive centralized storage.

- Excess LCFs due to transportation and traffic fatalities are minimal for all alternatives but greatest for the interim storage at the single site alternatives. The increase in excess LCFs to the public from radiological exposures during transportation is less than one for all alternatives.

- Western sites would tend to have slightly higher traffic fatalities associated with them than eastern ones due to the larger volumes of uranium materials to be shipped over greater distances.

- Commercial sites would have slightly greater impacts than DOE sites (except for PGDP) when comparing similar alternatives (interim centralized storage at a single DOE site versus a single commercial site and interim partially consolidated storage at two DOE sites versus two commercial sites).

Interim Centralized Storage at a Single Commercial Site Alternative. Considering the combination of normal operations, facility accidents and transportation, the "Interim Centralized Storage at a Single Commercial Site" alternative and the PGDP site for "Interim Consolidated Storage at a Single DOE Site" alternative have the greatest potential for environmental impacts. For normal operations, the western and eastern commercial sites and PGDP have equal impact potential. Any of these sites would have 305 first-year construction workers, 14 new permanent workers, $12.2M in new construction costs, and 7 acres of land commitment and habitat disturbance. Facility accidents would result in negligible to low acute and chronic risks.

Interim Centralized Storage at a Single DOE Site. Impacts are very similar to the single commercial site alternative discussed above; however, there are some differences in impacts among the DOE sites. Because PORTS has sufficient existing storage space, normal operations impacts, including socioeconomics, would be minimal at this site. Upgrading existing buildings at PORTS would not result in commitments of land or destruction of wildlife habitat that would be necessary at all other DOE sites.

Due to the very small amount of uranium storage space at PGDP, the impacts of normal operations would be almost identical to interim centralized storage at a single commercial site as noted above.

Interim Partially Consolidated Storage at Two Commercial Sites. Because none of the 14,200 MTU uranium inventory is now at these commercial sites, the normal operations impacts associated with this alternative are very similar to those for the "Interim Centralized Storage at a Single Commercial Site" alternative, except that environmental impacts would be shared by the two sites.

Interim Partially Consolidated Storage at Two DOE Sites. Environmental impacts from normal operations would tend to be less than from consolidation at two commercial sites, because some of the uranium inventory is already at INEEL and PORTS. Thus, less construction-related impacts would result. Human health and ecological risks from facility accidents would be the same as for consolidation at two commercial sites.

Interim Partially Consolidated Storage at Several DOE Sites. Because most of the uranium inventory would remain at the six prime DOE locations and only the 3900 MTU at 152 other sites would be relocated, the normal operations impacts would be substantially less than all the other action alternatives. Additional space requirements, and the impacts associated with construction of this space, would be sharply reduced when compared to the other action alternatives. This alternative most closely resembles the No Action alternative.

No Action. Because there is no new construction at any site, this alternative has the least normal operations impacts of any alternative and no transportation impacts. Facility accidents would result in low to negligible acute and chronic risks.

4.12 CUMULATIVE IMPACTS

Cumulative impacts are impacts associated with the proposed action when combined with other past, present, or reasonably foreseeable future impacts. There are no substantial impacts associated with the proposed action under normal operations. When the negligible-to-minor environmental and socioeconomic impacts associated with normal operations (construction of new storage facilities, facilities upgrades, and daily maintenance and surveillance) and any of the action alternatives are added to the baseline environment, cumulative impacts are minor.

For facility accidents, the potential for negligible to low acute consequences and risk, due to either storage area fires or seismic events, exists for the "Interim Centralized Storage at a Single DOE Site" alternative and "Interim Centralized Storage at a Single Commercial Site." Under a major seismic event scenario sufficient to mobilize uranium oxide into the environment, it is reasonable to assume that other material releases and other risks would be posed to workers at the site. Therefore, risks from uranium oxides would be one of several environmental and health risks that workers at the sites would face. For other accidents and other forms of uranium materials, the acute and chronic human health risk and ecological risk are negligible or low.

Due to a small increase in vehicular traffic to transport uranium materials, there would be a slight increase in traffic accidents and fatalities on the nation's highways. These cumulative impacts would be very minor in comparison to the baseline. Likewise, exposures of the public and workers during uranium transport would increase very slightly the risks of LCFs.

At some time in the future, the uranium inventory would be eventually dispositioned. Various disposition options including commercial processing and domestic sales of the entire inventory, disposition of limited quantities (50 MTU) at research facilities, disposition of 2,500 MTU to other government agencies, and foreign sales of 4,050 MTU may occur. Impacts associated with these options are considered as a part of each of the interim storage alternatives. In addition, potential cumulative impacts (such as temporary storage costs, new construction, and additional labor) could occur should an existing inventory of uranium materials be increased at any of these disposition option locations.

4.12.1 SRS

There is a large inventory (~19,000 MTU) of uranium, mostly oxides, at the SRS, which is not part of the UMG inventory. For an accident risk perspective, cumulative impacts could be important at SRS (due principally to this existing, non-UMG uranium oxide inventory). Centralized storage would add 11,300 MTU to the 2400 MTU already included in the UMG inventory.

In addition, up to 7 acres of site habitat at SRS would be devoted to new construction, removing these acres from current use. This acreage, when considered from a total site perspective, would be a minimal cumulative impact since portions of SRS are undergoing remediation or being dedicated to greater environmental uses.

4.12.2 PGDP

The PGDP site would need the largest amount of new construction including 7 acres of permanent habitat disruption. This disruption would occur at a site undergoing ground-disturbing remediation efforts, which also affect wildlife habitat, albeit of low quality in most cases. Because of the small workforce at PGDP, direct construction-related increases in employment would be greatest at this site. Due to declining DOE employment at the site, however, the overall cumulative impact would likely be temporary but beneficial for the regional economy.

4.12.3 PORTS

The PORTS site has an existing inventory of uranium materials. Should the approximately 9800 MTU of additional inventory evaluated in this EA be added to the existing inventory, then the potential for cumulative impacts due to accidental releases would increase. Since PORTS currently has sufficient existing storage space for the 14,200 MTU, the site has the lowest potential for cumulative impacts due to construction/renovation. However, as noted, DOE is committed to using the existing UMG storage facility and upgrades to other buildings for uranium storage associated with the UMG program would not occur.

4.12.4 INEEL

Like the PGDP site, INEEL would require substantial new construction with associated permanent habitat disruption. This 7-acre commitment would occur at a highly developed site undergoing other ground disturbances associated with remediation. This site also has uranium inventory that is not part of the proposed action so cumulative impacts from accidental releases are possible.

4.12.5 Oak Ridge

The two sites at Oak Ridge would also require a commitment of land for new construction. Even though there are also other uranium inventories in Oak Ridge, the physical separation of the two sites lessens the potential for cumulative impacts due to accidental releases.